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# B.Tech. (Electronics Engineering/Electrical & Electronics) (OE 2012 Onwards) (Sem.–6) ELECTRICAL MACHINES Subject Code : BTEEE-OPA Paper ID : [72838]

### Time: 3 Hrs.

Max. Marks : 60

## **INSTRUCTIONS TO CANDIDATES :**

- 1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
- 2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
- 3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

### **SECTION-A**

#### 1. Write briefly :

- a) What are the effects of armature reaction in DC machines?
- b) List the different types of DC generator.
- c) Why an open circuit test is generally preferred at rated voltage on LV side of a transformer?
- d) Define voltage regulation of a transformer.
- e) Name the various starter used for starting the three phase induction motor.
- f) What are the advantages of cage motor?
- g) What are the various method available for making single phase induction motor self-starting?
- h) What is energy balance equation?
- i) Give the expression for energy density of magnetic field.
- j) Give the examples of singly-exited and doubly excited electromechanical energy conversion devices.



#### **SECTION-B**

- 2. Write the essential conditions for parallel operation of two single phase transformers. How circulating current effects no-load operation when two transformers are connected in parallel?
- 3. Explain the working principle of DC generator, also derive the emf equation.
- 4. Derive the expression for field energy and torque developed in doubly-excited magnetic system.
- 5. The armature resistance of a 220 V shunt motor is  $0.4 \Omega$ . and no-load current is 2 A. When loaded and taking an armature current of 50 A, the speed is 1200 rpm. Find approximately the no-load speed.
- 6. Draw the equivalent circuit of three phase induction motor, also explain torque slip characteristics.

# SECTION-C

7. A 15 kVA, 2300/230 V, 50Hz single phase transformer gave the following test data :

Open-circuit Test  $V_0 = 2300V$ ,  $I_0 = 0.21A$ ,  $W_0 = 50W$ 

Short-circuit Test  $V_s = 47V$ ,  $I_s = 6A$ ,  $W_s = 160W$ 

- a) Find the equivalent circuit referred to high voltage side.
- b) Calculate the full-load voltage regulation at 0.8 pf lagging when the load voltage is held constant at 220V.
- c) What is the efficiency at half the rated load at unity power factor?
- 8. Derive the expression for field energy and torque developed in doubly-excited magnetic system.
- 9. A three phase, 4-pole, 50 Hz induction motor has a slip of 4%. Calculate : (a) speed of the motor and (b) frequency of rotor emf. If the rotor has a resistance of 1  $\Omega$  and standstill reactance of 4  $\Omega$ , calculate the power factor (i) at standstill and (ii) at a speed of 1400 rpm?